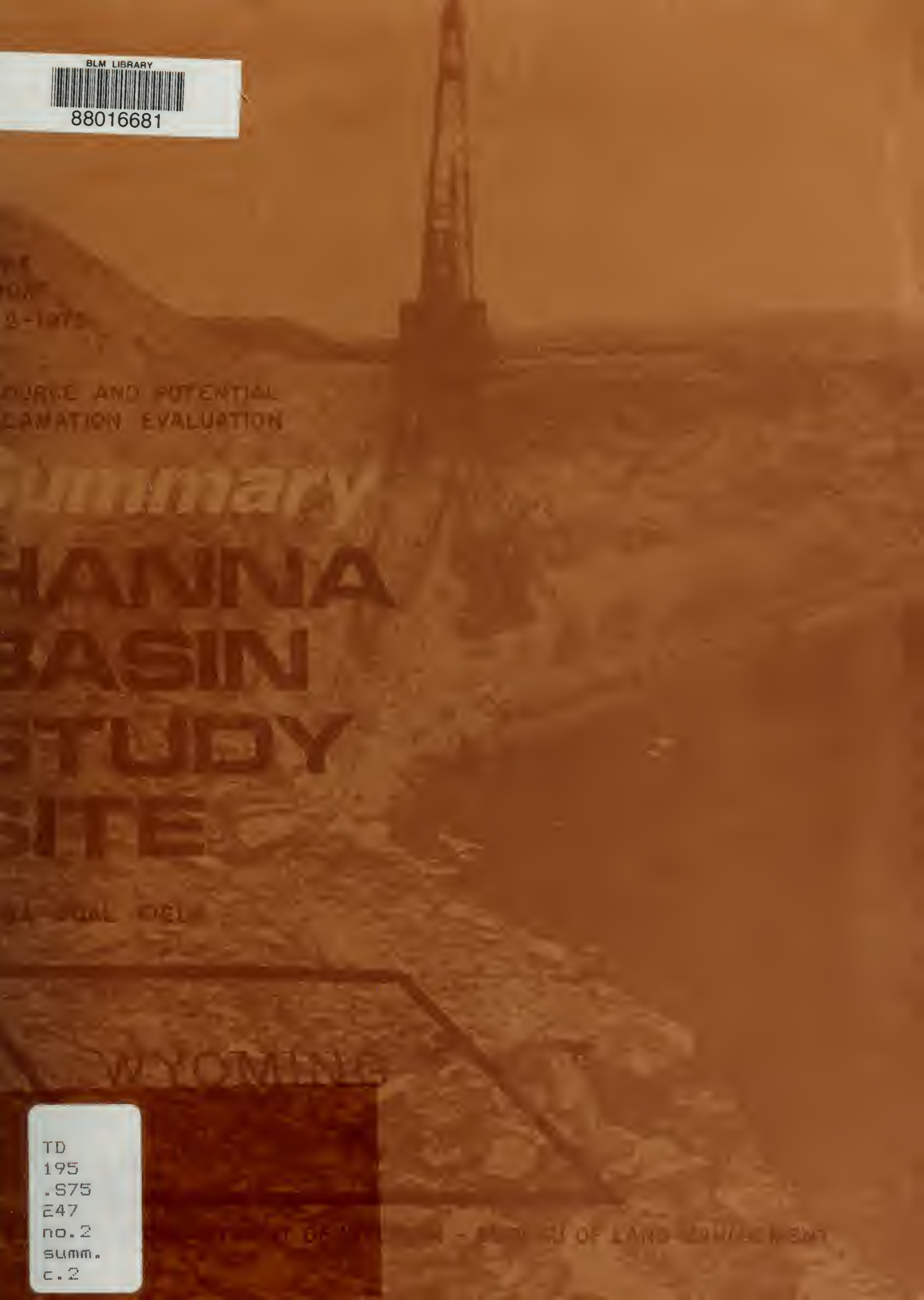

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... - BUREAU OF LAND MANAGEMENT

HANNA BASIN STUDY SITE

SUMMARY AND RECOMMENDATIONS

Introduction

The following represents a brief nontechnical summary of conclusions and recommendations for the detailed studies on the Hanna Study Site. Back-up data may be found in the main report. The study site is located in Carbon County, Wyoming approximately 40 miles northeast of the town of Rawlins, and contains about 2,400 acres. The site includes parts or all of sec. 6, T. 23 N., R. 83 W.; sec. 12, T. 23 N., R. 84 W.; secs. 30 and 32, T. 24 N., R. 83 W.; sec. 36, T. 24 N., R. 84 W. (2,400 acres).

Climate

Hanna Basin is characterized by semi-arid climate with mean annual precipitation of approximately 12 inches and a mean annual temperature of 43° F. Annual temperature fluctuations exceed 100° F. Diurnal fluctuation of temperature generally range from 30° to 60° F. Daily freeze-thraw conditions exist on the average from mid-October to late April. Approximately 70 percent of the annual precipitation occurs during the months of October through May, much in the form of snow. Approximately 40 percent of the mean annual precipitation occurs during the spring months of April, May, and June.

The frost-free period is about 100 days. The time between the last frost in the spring and the date potential evapotranspiration (PET) exceeds available moisture is 60 to 70 days. This period begins in late April and lasts until early July. Even though mean annual precipitation appears to be adequate for reclamation, there will be occasional dry years when plant establishment will be difficult without supplemental watering.

Geology

Approximately a 200-foot depth of the Ferris Formation, which overlies the Medicine Bow Formation, was evaluated. Rock types encountered were: sandstone 30 percent, siltstone 30 percent, shale 30 percent, mudstone 3 percent, coal 7 percent. Eight drill sites (1,325 feet) for extraction of solid core samples (1,162 feet) were evaluated.

Coal

The estimated identified coal resources on study site (2,400 acres) in thousands of tons are:

Bed Thickness (feet)	Overburden Thickenss 0 - 100 M Tons	100 - 200 M Tons
2.5 - 5.0	2,100	1,662
5.0 - 10.0	2,446	3,018
10.0+	119	904
	4,665	5,584

These estimates when extended to the representative area around and including the study site are 20 million tones in the 0- to 100-foot depth, and 21 million tons in the 100- to 200-foot depth.

Coal is classed as low-sulfur and ranked as high volatile C bituminous.

Bed	Samples Taken	Range In As Received Values: Percent Moisture	Ash	Sulfur	BTU
No. 24	1	10.5	4.2	.32	10,330
No. 82	1	12.1	9.8	.92	10,380
Hanna No. 2	1	10.7	10.3	.72	10,650
Unnamed	1	12.6	5.4	.63	10,820
Unnamed	1	11.2	13.1	.29	9,840

Suitability of Soil and Overburden for Revegetation

Soil

Topsoils are thin, shallow or non-existent. Where topsoil or other suitable soil material capable of supporting plant growth do occur, they should be given top priority as a plant growth medium for reclamation. This material is inherently more suitable for revegetation due to its higher (than sub-surface geologic materials) content of organic matter, microorganism content, physical condition, presence of viable seeds, and the fact that it is now supporting vegetation. There is not sufficient top soil on the study site to cover all backfill material assuming all strippable coal on the site was mined. Therefore, additional overburden materials or soil materials from adjacent areas must be used in the reclamation process. A rating was made of the study site to express the suitability of surface soils as a suitable source of resurfacing material for revegetation purposes.

Mapping unit No. 8001 represents 3 percent of the study site. (Poor) It is generally satisfactory from a chemical standpoint, but these soils are not sufficiently permeable or friable to obtain good seed germination or plant growth. This series shows good depth, and its use as a mixture with lighter textured material would be acceptable should a shortage of more suitable materials occur.

Mapping unit No. 8010 represents about 9 percent of the study site. (Good) This is a moderately deep, medium to moderately coarse textured soil with suitable chemical characteristics. This source represents a relatively large source of surface backfill material suitable for plant growth.

Mapping unit No. 8020 represents about 22 percent of the study site. (Fair) This is a shallow soil or medium to moderately fine texture and moderate chemical deficiencies. Somewhat high sodium and soluble salt levels render this soil less than ideal as a source of material for plant growth, and its shallowness limits the quantity of material available.

Mapping unit No. 8030 represents 50 percent of the study site. (Poor) This is a shallow soil of light texture and suitable chemical characteristics. This soil's shallowness and lack of development render it a poor source of backfill material.

Mapping unit No. 8040 represents only about 2 percent of the study site. (Poor) This is a shallow, very coarse textured soil with good chemical characteristics. Due to its very light texture, this material would have to be mixed with finer textured material in order to be used as a source of surface backfill.

Mapping unit No. 8050 represents about 14 percent of the study site. (Poor) This is a land type rather than a developed soil, and consists of rock outcrops, eroded areas and very shallow lithosols. It would be almost entirely unsuitable as a source of backfill material for plant growth.

<u>Overburden</u>

Only 25 percent of the total length of all core samples were identified as suitable for placement on the surface. Natural variation from hole to hole makes it impractical to generalize the quantity of suitable material except to point out that it varied from a maximum of 71 feet in hole No. 9001 to zero at hole No. 9005. This serves to indicate that caution will be needed in acceptance of future reclamation plans. Material for support of vegetation is available, but it may be necessary to transport, mix, stockpile, or otherwise obtain it where needed and at the depth needed.

Vegetation

At present, the general aspect of the vegetation is northern desert shrub and is similar to extensive areas in Utah and Nevada. Big sagebrush is the dominant species over large areas but birdfoot sagebrush, a species whose distribution is limited almost entirely to the State of Wyoming, also covers a large part of the site. Halophytes such as nuttal saltbush, shadscale, and greasewood occur in several places on the site. One or more of the following grasses occur abundantly as understory species in most of the vegetation types: Western wheatgrass, Sandberg bluegrass, Bluebunch wheatgrass, and Indian ricegrass. Surprisingly few forbs occur in the area; pussyto s and longleaf phylox were the only two present in the plots sampled.

Hydrology

Streams draining the study area are ephemeral and most flow directly into Seminoe Reservoir. Streamflow is highly variable and occurs mainly as a result of runoff of snowmelt or rainfall.

As with most plains-type streams, the quality of the runoff is proportional to the magnitude of the flow. Concentrations of suspended sediment, and turbidity, generally increase as flow increases, whereas, concentrations of dissolved solids decrease as flow increases. Dissolved-solid concentrations range from 300 to over 1000 mg/l.

The water supply of the area is meager and mining operations will have little effect on the areas runoff. Reclamation of mined land should be planned so that channel characteristics, including density, pattern, and slopes, are re-established to their natural values. During mining and revegetation, efforts should be made to prevent off-site degradation.

From the data available, it appears ground-water supply in the specific site is very limited in yield and quality. The gradient of the water levels appears to be toward the Seminoe Reservoir. Coal beds in the area are water-saturated and dewatering will be necessary during mining operations to prevent flooding. Efforts must be taken to assure that dewatering is accomplished under controlled conditions thereby preventing adverse off-site impacts. It will be necessary to consider the possibility of several dewatering actions occurring at the same time in arriving at permissible discharges. One operation may not produce significant adverse affects, but several simultaneous operations could result in detrimental effects.

As there is not significant development of ground water in the area, dewatering operations will not significantly affect local users. However, water levels in the area should be monitored for the possible effects of pumping on the reservoir. This will be done as part of the continuing water studies initiated by this study.

Sediment

Present source-area sediment yields on and near the study site vary from none to about 2 acre-feet per square mile. Differences in the slope of the land, the type of soil, and the associated amount of vegetation and rock cover appear to be the main factors that cause the variation in source-area sediment yields. Sediment yields from small drainage basins to Seminoe Reservoir are low, ranging from 0.1 acre-feet to 0.3 acre-feet per square mile for much of the study site. Temporary reservoirs, and/or artificially created closed drainage basins and/or water spreaders may be necessary to prevent increased sediment discharges to Seminoe Reservoir during the mining and reclamation periods.

Recommendations for Reclamation

Surface Manipulation

Effective shaping of spoils regardless of their origin as soil or overburden material must have a preconceived design so that they blend with the adjacent topography of undisturbed lands, minimize drainage problems, prevent erosion, and facilitate revegetaion. In the study area, it is recommended that the spoil piles be graded to a rolling-type topography with slopes not steeper than 4:1, and wherever possible they should perferably be graded to a 5:1 slope or less. To further aid in the reestablishment of vegetation, the finished area should maximize north and east facing slopes. South and west facing slopes are traditionally drouthier and hotter slopes, thus making them much more difficult to revegetate. Drainageways should be provided in the topographic design of the areas and graded in a manner to prevent gullying and excessive channel erosion. Final grading should insure that no flat areas are created which will pond water unless temporary ponding is desired for erosion control. Surface protection from sustained high winds is essential. One method to reduce surface erosion, trap winter snow and protect growing seedlings is installation of snow fencing, 5 feet to 6 feet in height. These fences should be installed perpendicular to the prevailing winter and spring winds and should be spaced no more than 100 yards apart.

Planting Recommendations

Planting plans should be based on a sound knowledge of the reconstructed surface-mined area. The first step should be a survey to determine land characteristics important to revegetation.

Avoid monocultures in grass stand selection. Choose a good mix of adapted species which are drought resistant and have good sod forming characteristics. The grasses, legumes, and shrubs listed on the following page are suggested.

Grasses: Western wheatgrass (Agropyron smithii), Indian ricegrass (Oryzopsis hymenoides), Thickspike wheatgrass (Agropyron dasytachyum), Needle-and-thread (Stipa comata), Sand dropseed (Sporobolus cryptandrus).

Legume: Yellow sweetclover (Melilotus officinalis).

Shrubs: Four wing saltbush (Atriplex canescens), Winterfat (Eurotia lanata), Nuttal saltbush (Atriplex natallii).

Reclamation plans must consider the long period of moisture stress in the summer and severe frost hazards in the fall and spring. Fall seeding, preferably before October 15th appears to produce the best results in this area. Grasses and legumes should be planted as soon as possible following seedbed preparation. Fall seeding provides an opportunity to capitalize on water and early spring climatic conditions and insures full use of the spring growing season which normally begins in April.

It is recommended that surface manipulation such as ripping, contour furrowing, pitting, chiseling, etc., be employed immediately after the final surface grading is completed. These practices will assist in breaking up and roughening the surface, prevent wind erosion, increase water intake, breakup compaction in the root zone, and maximize the availability of precipitation for use.

Drilling should be given first consideration for seed application.

Consideration should be given to the use of mulches. Native grass hay or straw mulch should be applied at the rate of 4000 to 5000 pounds per acre and anchored immediately following application by use of a mulch anchoring machine, to the surface material. Readily available gravel or crushed rock can also be used as a surface mulching material to stabilize the disturbed surface against wind erosion.

Greenhouse studies indicated that the disturbed lands are deficient in nitrogen and phosphorus. Based upon the studies, 100 to 150 pounds per acre of triple super phosphate should be applied in the soil prior to seeding and 10 to 15 pounds per acre of available nitrogen fertilizer applied during or immediately following the seeding operation. As the seeding starts growing and before becoming established, additional applications of nitrogen fertilizer will be required.

Management

All reclaimed areas should be fenced to protect them from livestock grazing until the District Manager determines that the planted vegetation is sufficiently developed and established to withstand grazing use without damaging the overall vegetative cover. In the noxious weeds invade the reclaimed site, the local manager should use acceptable methods of control to remove them from the plantings before desirable range plants are "crowded out" of the reclaimed area.

General

Data collection and analysis related to this study was perhaps more intensive than any prior study of this type conducted by BLM. It was sufficient to point out problems and methods to minimize adverse affects on reclamation in quantitative terms. It was not, however, sufficient to develop detailed specifications or stipulations for mining and reclamation plans. The study sets the stage for potential mining companies to expand on these data in particular areas of concern. It also points out the need for the Bureau to document as accurately as possible all baseline data involving the resource values and uses which will be affected by surface mining such as:

Vegetation Inventory - i.e., composition by species; percent cover; estimated AUM's for livestock; estimated AUM's for wildlife.

Description of Uses - i.e., class of livestock; AUM's licensed or permitted; wildlife which occupy or range in the area; recreational; instructional or educationa; other.

Written and Photographic Documentation - significant geologic, archeologic, historic or cultural features.

Description of Watershed Values - i.e., soil surface factor; erosion classification.